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CITY OF CONCORD

CONSTRUCTION STANDARDS

2005

I. REFERENCES

All work performed in the City of Concord, New Hampshire shall conform to the requirements of the latest edition of this manual and the following standards:

For addendums to the standards and other information, please visit the website at http://www.onconcord.com/engineering

A. Standard Specifications and drawings for Road and Bridge Construction of the New Hampshire Department of Transportation, 2002 Edition, as most recently adopted.

B. Construction Standards for Sanitary Sewer and Water Supply Systems of the New Hampshire Water Supply and Pollution Control Division.

C. Administrative Rules for the Permitting of Driveways and Other Accesses to the State Highway System, NHDOT, Bureau of Highway Maintenance.

D. Manual on Uniform Traffic Control Devices for Streets and Highways, published by the United States Department of Transportation, Federal Highway Administration; 2003 Edition.

E. Requirements of the Community Development Department Street Excavation, Driveway and Encumbrance Permits.

F. Subdivision and Site Plan Regulations and the Municipal Code of Ordinances of the City of Concord, New Hampshire.

G. City of Concord's Building and Plumbing Codes, and the International Plumbing Code, 2003 Edition.

H. Occupational and Safety Health Administration and The City of Concord Confined Space Entry Policy, latest edition.

I. Construction Observation Manual (COM), City of Concord, 2004 Edition.

J. Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire, New Hampshire Department of Environmental Services, latest edition.

K. A Policy on Geometric Design of Highways and Streets, AASHTO, 2004 Edition.

THE CONTRACTOR/DEVELOPER/OWNER SHALL BE RESPONSIBLE FOR ALL COSTS INVOLVED IN REQUIRED TESTING, AND WILL BE BILLED FOR ALL INSPECTIONS AND TESTING PERFORMED BY CITY FORCES.

II. GENERAL INSPECTION REQUIREMENTS

Several City Divisions are involved in the inspection of a project once construction is underway. The following table on Page #3 outlines each division's inspection responsibilities. The Community Development Department is the lead agency concerning construction of public and private improvements. Therefore, an applicant or contractor should first contact the Community Development Department if they have general questions regarding the construction inspection process. Specific questions should be addressed to the appropriate division listed in this section.

CITY OF CONCORD

Community Development Department

Construction **I**tem	**D**ivision	**C**ontact **P**erson
Bridge information. **D**riveway permits. **S**anitary sewer systems. **S**torm drain systems. **S**treet encumbrances. **S**treet excavations. **S**treet construction. **S**treet records. **T**raffic counting. **W**ater service systems.	**E**ngineering **S**ervices	**C**ity **E**ngineer (225-8520)
Building construction inspection: electric mechanical, & plumbing. **F**ire protection systems and life safety code. **H**ealth & food service licenses. **H**ousing code. **S**ign & yard sale permits. **Z**oning Ordinance.	**B**uilding and **C**ode **S**ervices	**C**ode **A**dministrator (225-8580)
Landscaping. **S**ite compliance. **S**ubdivision regulation.	**C**ommunity **P**lanning	**C**ity **P**lanner (225-8515)
Municipal fire alarm cable. **T**raffic signal systems.	**F**ire **A**larm / **T**raffic **S**ignals	**F**ire **A**larm **S**uperintendent (225-8667)
General Services Department		
Automated meter reading. **B**ackflow prevention. **W**ater metering. **W**ater and **S**ewer Investment Fees	**A**dministration	**W**ater **S**upervisor (225-8693)
Sewer maintenance. **W**ater maintenance.	**H**ighways and **U**tilities	**H**ighway & **U**tility **S**ystems **S**uperintendent (228-2737)

III. GENERAL REQUIREMENTS

A. SITE CONDITIONS

The Contractor shall promptly notify the City Engineer of any unusual conditions such as:

1. Subsurface or latent physical conditions at the site differing materially from those indicated on the approved plans;

2. Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent to work of the character provided for in the approved plans.

3. Encounters with a utility, whether damaged or simply unearthed, should that utility be mislocated or missing on the approved plans or should that utility be found in an unusual or deteriorated condition.

B. DIG SAFE

The contractor shall be responsible for contacting Dig Safe 1-888-344-7233 (**1-888-DIG-SAFE**) at least 72 hours prior to commencement of work. The City is a member of Dig-Safe, yet the Contractor shall coordinate their work with the following City Departments: Fire, Police, and the Community Development Department. The location of all utility facilities shall be determined sufficiently ahead of excavation work to avoid damage and permit their relocation if necessary.

C. CONTROL OF THE WORK

1. Responsibility of Contractor: The contractor is responsible for the construction of all improvements as shown on the approved plans. The contractor shall employ a competent construction supervisor or management team capable of establishing and maintaining all horizontal and vertical layout control, bench marks and structure locations to assure that all improvements will conform to the locations, lines, levels, and grades as indicated on the approved plans. Should site conditions warrant modifications to the approved plans, such changes shall be approved by the appropriate City Department prior to commencement of the work.

2. Compliance to Requirements: The contractor shall provide all City staff safe access to the work for the purpose of ascertaining that the work is in accordance with City requirements, even to the extent of uncovering or taking down portions of finished work.

3. The contractor shall comply with the City Code of Ordinances particularly with respect to fugitive dust (Article 11-3) and noise/ hours or work/holidays (Article 13-6-8).

4. The contractor shall also comply to the **2004 Policy on Construction Practices in The City of Concord to minimize disturbance and damages.** In summary, this policy describes that the City Engineer has the authorization to instruct the contractor to monitor vibrations not only during blasting operations but also during intensive construction projects (i.e., deep roadway cuts but not limited to, in close proximity to homes, etc.) to minimize disturbances to the surrounding neighborhood. The City Engineer will enforce the guidelines from N.H.D.O.T. Standard Specifications for Road and Bridge Construction - Section #203 and #211.

D. BACKFILL AND COMPACTION

1. All backfill material adjacent to pipes and structures shall be compacted in layers not exceeding 12-inches of compacted thickness, by pneumatic tampers, vibratory plate compactors or rolling compactors. Care shall be exercised to thoroughly compact the backfill under haunches of pipe and to assure that the backfill soil is in intimate contact around structures. Material in the trench backfill shall be compacted to not less than 95 percent of American Association of State Highway and Transportation Officials (AASHTO) T180, Modified Proctor. Nuclear density testing methods will be governed by ASTM D2922.

2. Backfill and fill material used in roads, travel ways and shoulders shall be natural material excavated from the trench during construction excluding: all debris, pieces of pavement, organic material, all wet or soft muck, peat or clay, all excavated ledge material, or rocks over 6 inches in largest dimension, or any material not approved by the City Engineer. Materials shall be backfilled from the blanketing material over pipe to the base of the roadway structural box and compacted in layers not to exceed 12 inches in compacted thickness by mechanical compaction means described above. Compaction testing shall be ordered at the expense of the contractor if deemed necessary by the City Engineer. Water jetting or ponding methods of compaction shall not be allowed.

3. Deep excavations or excavations through areas of unsuitable material: The contractor may be required to perform extraordinary construction methods when encountering deep excavations or unsuitable materials. Alternate materials may be required to prevent long-term deflection in these areas; yet pipe materials shall remain continuous between structures. Compaction testing of the backfill material may be required at the discretion of the City Engineer or their agent. This testing shall be performed at a minimum of 200-foot intervals to assure proper compaction in roadway sections. Any required testing shall be performed at the expense of the Contractor unless other arrangements have been established with the Engineering Services Division.

E. CONFINED SPACE ENTRY

1. DEFINITION

Confined spaces normally include tanks, vessels of any type, underground pump stations, manholes and catch basins, vaults, meter pits, chemical storage areas, pipe chases, etc. Under certain conditions, such as the presence of soil contamination or organic deposits, even open construction trenches may pertain.

2. POLICY REQUIREMENTS

Should any Contractor, Skilled Trade Worker, or Private Individual find it necessary to enter a confined space owned, maintained or operated by the City of Concord they must comply with the City of Concord's Confined Space Entry Policy. Should a City employee be required on a private site; the owner will be responsible to comply with the Occupational Safety and Health Administration and the City's of Concord's Confined Space Entry Policy.

F. MAINTENANCE OF TRAFFIC

1. SCOPE:

This work shall consist of providing and maintaining safe and passable traffic accommodations for public travel, preventing dust nuisance, furnishing, erecting and maintaining construction signs, barricades, delineator lights, flashers and other warning devices as shown on the plans or as required by the City Engineer or their designee. All traffic control devices used on street and highway construction, maintenance, utility or incident management operations shall conform to the 2003 Edition of the Manual on Uniform Traffic Control Devices (MUTCD) for Streets and Highways.

2. CONSTRUCTION REQUIREMENTS:

A City Excavation Permit is required of all Contractors performing work within a Public Street. A DIG SAFE Request Number is needed for an Excavation permit. The Contractor shall provide and maintain a sufficient surface for at least one lane of traffic, (minimum 12-feet width), controlled by the use of flaggers, 2-way radios or pilot vehicles. Construction materials or equipment shall not be left within the public right-of-way during work suspensions.

A Traffic Control Plan (TCP) will be required for maintaining vehicle and pedestrian traffic for most sites. The traffic control plan must be designed, submitted and signed by a qualified traffic control engineer. The TCP shall be submitted to the City Engineer for review **at least two (2) weeks prior to the Mandatory Preconstruction Meeting**. Under no circumstances will a "marked-up, hand copy" be deemed as a TCP.

3. CONSTRUCTION SIGNS:

All construction signs, barricades and warning devices shall be installed prior to the commencement of work activities and shall be free of chipping or damage that may render the device unsatisfactory or detract from reflectiveness.

All construction signs as shown on the plans or as ordered by the City Engineer or their designee shall be erected on posts, barricades or easels so that all text is horizontal. At any time during the life of the project, at the discretion of the City Engineer, any sign, barricade or warning device that is damaged, disfigured or found not to be in serviceable condition shall be required to be replaced at the cost of the Contractor.

Should a road closure be necessary, the contractor is responsible for preparing a TCP, in accordance the 2003 Edition of the *Manual on Uniform Traffic Control Devices* (MUTCD) and a written request for the proposed closure. The traffic control plan must be designed, submitted and signed by a qualified traffic control engineer.

Prior to the anticipated date of the road closure, the contractor shall submit the TCP, along with the written request, at least two (2) weeks prior to the closure to the City Engineer for review.

The City Engineer will review and then provide his/her recommendation to the City Manager for the approval of the proposed road closure. No roadway closure can occur without the approval from the City Manager.

F. MAINTENANCE OF TRAFFIC (continued)

4. BARRICADES:

Barricades and delineators shall be placed wherever necessary for the protection of public travel. Such hazards as pits and open trenches, drop offs, exceptionally rough stretches of roadway and all obstructions shall be barricaded in an acceptable manner. The contractor shall make all necessary arrangements for nighttime shutdown, to ensure that there are not any hazards to the traveling public or pedestrians.

5. LIGHTING:

Lighting devices shall be placed so they are clearly visible. Adequate artificial lighting shall be provided on construction projects to clearly reveal all hazards during night hours. Flagger stations and all hazards shall be lighted from sunset to sunrise should night work be approved.

6. DUST & NOISE CONTROL:

The control of fugitive dust (City Ordinance Article 11-3) , throughout the duration of the construction project, shall be performed in an approved manner, generally by use of water or calcium chloride application and shall be continued on a regular basis whenever necessary or as ordered by the City Engineer. The contractor shall be responsible for the control of dust during work suspension periods as well. Work suspension periods include, but not limited to weekends, holidays, etc.

City Ordinance Article 13-6-8 (Public Nuisance) has deemed any noise generated from construction activities that are clearly audible other than between 7:00 a.m. and 7:00 p.m. on weekdays to be a public nuisance. Contractor's can only work from 9:00 a.m. to 7:00 p.m. on Saturday's and no work shall be performed on Sunday unless it is an emergency and a waiver must be approved by the City of Concord Code Administrator. Refer to the article for further information regarding Holiday work restrictions.

IV. SANITARY SEWERS

A. MATERIALS

Certificates of Compliance shall be submitted by the Contractor for each material to the City of Concord's Representative for review and approval.

1. PIPE

a. **Polyvinyl Chloride (PVC) pipe:** Pipe and fittings shall conform to ASTM D-3034 and shall be SDR 35. Pipe and pipefittings between manholes are to be of the same manufacturer. Joint compression rings shall be of an oil resistant rubber type, elastomeric seals conforming to ASTM D-3212, or flexible elastomeric seals conforming to ASTM 3212. Manufacturer's certificate of compliance shall be furnished to the City prior to installation.

b. **Reinforced concrete pipe (RCP):** Pipe shall conform to the standard specifications for reinforced concrete sewer pipe, ASTM Designation C76; pipe shall be Class V.

The pipe shall be subject to rejection at any time due to failure to meet any of the specification requirements.

The pipe interior shall comprise a continuous internal concrete skin and shall be smooth and even, free from roughness, projections, indentations, offsets, corrugations, exposed reinforcing or, other irregularities.

The pipe shall be clearly marked as required by the American Society for Testing Materials (ASTM) C76, and shall not be shipped until 5 days after manufacture. Pipes that have been damaged during or after delivery will be rejected, and if such pipe has already been laid it shall be acceptably repaired (if permitted), or removed and replaced.

c. **Ductile iron (DI) pipe:** Ductile iron pipe shall conform to ANSI/AWWA C150/A21.50 with size as shown on the drawings. Pipe shall have either the rubber ring type, push on joint, or standard mechanical joint. Rubber gasket joints shall conform to ANSI A21.11 for mechanical and push on type joints. All pipe and fittings shall have a cement mortar lining and bituminous seal coat on the inside, and a coal tar enamel coat on the outside.

ALL MATERIALS DESCRIBED SHALL MEET ALL THE STANDARDS SET FORTH AS MINIMUM REQUIREMENTS.

2. FITTINGS AND ACCESSORIES

a. Compatible construction materials: All fittings shall be of compatible construction materials and shall be used exclusively for the intended purpose of the manufacturer. All fittings used for repairs must first be approved by the Engineering Services Division prior to installation.

b. New materials only: Only new materials will be accepted for installation.

c. Repair couplings: Rigid wrap-around stainless steel and PVC repair couplings or ductile iron couplings will be allowed on mainline repairs. The use of Fernco couplings may be used when field conditions do not allow for other types of couplings. The use of Fernco couplings must be approved by the City of Concord's Representative.

d. Line or grade requirements: Should any pipe line be found unsatisfactory due to nonconformance to line or grade requirements or due to conflicts with other utilities and an adjustment in place will not correct the situation thus requiring the pipe to be physically removed; then the pipe may not be considered for reuse unless inspected and approved by the City of Concord's Representative.

3. STORAGE AND HANDLING

a. Preventing damage: All materials shall be handled in a manner to prevent warping, twisting, bending, breaking, chipping, rusting or any damage whatsoever. Pipe and structures shall be lifted and moved with the appropriate apparatus without being pushed, pulled or rolled by equipment.

b. Storage of cement: Cement shall be stored under cover, off the ground, and shall be kept completely dry at all times.

c. Storage of reinforcing steel: All reinforcing steel shall be stored off the ground, or otherwise to prevent accumulations of dirt or grease, and in a position to prevent accumulations of standing water to minimize rusting.

d. Precast concrete handling: Precast concrete units shall be handled in a manner to prevent chipping or cracking.

e. Handling and storage of masonry products: Brick, block and similar masonry products shall be handled and stored in a manner to reduce breakage, chipping, cracking and spalling.

f. Damaged materials: All materials that have become so damaged as to be unfit for the intended use shall be promptly removed from the work site.

4. STRUCTURES AND APPURTENANCES

a. Standard sanitary manholes: Manholes will be of precast concrete construction; precast concrete barrel sections and precast manhole bases shall conform to ASTM Designation C478. The wall thickness shall not be less than 5 inches for 48 inch inside diameter structures, or 6-inches for 60-inch and 7-inches for 72-inch inside diameter barrel sections. Lift holes and boot recesses are to be sealed with Portland cement mortar flush to the outside structure wall prior to backfilling. Refer to Detail #9.

Concentric or eccentric cone sections with 30-inch openings are required, except where the cover over the top of the pipe is less than:

1. 5-feet for 48-inch diameter manholes, or
2. 7-feet for 60-inch and 72-inch diameter manholes, in which case, precast concrete top slabs designed for H-20 loading may be allowed.

b. Work under the control of the General Services Department: The contractor may make the tap onto a sewer main and install service laterals to the property line, or request the General Services Department's utility forces to install services should they be available.

In the former, the contractor will be required to deposit the funds estimated to cover the cost of the City's Inspector assigned to the project.

In the latter case, the applicant will be required to deposit separate funds estimated to cover the cost of the General Services Department's utility forces (not to be confused with the Engineering Services Division inspection fees).

c. Special structures:

1. Inside drop structures for mainline sewer construction require a minimum 60-inch inside diameter manhole. Manholes with service connections greater than 6-inches in diameter also require a 60-inch minimum manhole diameter. Inside or outside drop service connection details must be submitted to the Engineering Services Division for approval prior to construction. Larger structures are preferred over outside drop structures for new construction. Refer to Details #9 and #11.

2. Should more than 4 service laterals be proposed for one manhole, then a 60-inch minimum inside diameter structure will be required.

3. Inside drop house service connections are preferred over outside drop service connections.

4. The use of sanitary sewer "doghouses" is not permitted unless approval has been granted by the City Engineer.

d. All cast iron manhole frames and covers are to be set no less than 1/8-inch lower than finish pavement and catch basin frames and grates are to be set no less than 1/4-inch lower than finish pavement. *North American Castings are only allowed and shall be designed for H-20 Loading.*

4. STRUCTURES AND APPURTENANCES – (continued)

e. All brickwork used to adjust manhole and catch basin frames to grade shall be sealed on the outside of the structure with **Portland Cement Mix** - (see Detail #26 and Section D 1, d – Portland Cement Mix).

f. All brickwork used to adjust manholes and catch basins to grade shall be laid in a header course pattern - (end showing) as opposed to a batter course – (edge showing).

5. SERVICE LATERALS

a. Sewer Service Laterals: Building service connections are to be SDR 35 or SDR 26 PVC pipe. Cast iron pipe and ductile iron pipe may be used should conditions warrant. Penetrations at foundation walls and basement floors must be protected from abrasion by providing at least ½-inch clearance around the PVC. The void between the piping and the wall or floor slab (from the outside through to the inside) shall be sealed with an approved vermin resistant, waterproof, flexible, permanent sealant such as "Great Stuff" foam sealant or bituminous "Mastic" rope.

Whenever possible, all service connections shall be tied into a sanitary sewer manhole, if this is not possible then sanitary sewer service connections shall be accomplished by using an approved "Tee-Wye" fitting, as described in the City of Concord's Building and Plumbing Code Regulations, at the sanitary sewer main in the city street. The connection shall be made in accordance with the City of Concord's Building and Plumbing Code Regulations, and the International Plumbing Code, 2003 Edition.

Should an existing sanitary sewer service lateral need to be replaced, it shall conform to the standards described here within.

Service laterals greater than six (6) inches in diameter must terminate in a sanitary sewer manhole structure.

Ninety degree (90°) bends are **not** permitted for sanitary sewer service connections.

Sewer service lateral sizing shall be as follows:
- Single residential unit = 4-inch minimum.
- Commercial, Industrial or multifamily = 6-inch minimum.

Sewer service laterals shall be constructed with the following minimum slopes, yet not to exceed a 10% slope:

4 inch service = 1/4 inch per foot = 2%
6 inch service = 1/8 inch per foot = 1%
For inside drop connection in manholes refer to Detail #9.

Green detectable tape: green detectable "sewer" tape shall be installed in the sewer service trench on top of the 12-inch sand blanket on all sanitary sewer services - (see detail #33).
The service lateral shall be tested at the point of connection with the public sewer to a point within the foundation as provided by the plumber. A water test under a head of 10(ten) feet for 15 (fifteen) minutes or an air test of 4(four) psi for 5 (five) minutes will be accepted, (see BOCA P-1702.6).
Driveways should be avoided when determining the path of the service lateral.

5. SERVICE LATERALS (continued)

b. Clean Outs: Clean outs shall be constructed on service laterals as directed by the City's inspector and shall be located as follows:

- 4 inch and 6 inch service - one clean out at any directional change greater than 45-degrees.
- Clean outs will be constructed using "Wyes" (either 4x4x4 or 6x6x6 inch) and incorporating a 45-degree elbow to bring the stack vertical.
- A cast iron cleanout box with cover marked "sewer" is required over 4" & 6" sewer service clean outs - (see Detail #1 and #2) for appropriate sizes.
- Clean outs will be required at or near the property line for testing purposes should the installation **not be** completed to a building or a manhole structure.
- Each individual unit will have its own service connection and shall be accompanied by its own individual clean out.
- Clean outs shall be located outside of the City of Concord's R.O.W.
- Clean outs shall be located no greater than 100-feet apart unless otherwise directed by the BOCA Plumbing Code.
- Clean outs shall be avoided and installed only at the direction of the City inspector.
- Clean outs shall not be located within the City right-of-way.
- Clean outs shall be the same diameter as the carrying pipe, except for clean outs on service laterals greater than six (6) inches, where a six (6) inch clean out is acceptable.
- Clean outs shall be installed just upstream of bends (manufactured fittings). Only one clean out is necessary when two 45-degree bends are used to make up a 90-degree turn. A minimum of 2-feet of exposed pipe is required between bends.
- A clean out is required should a service lateral diameter be reduced between the sewer main and the building.

c. A backflow valve shall be installed where plumbing fixtures are subject to backflow from the public sewer (BOCA Plumbing Code P-1003.2). Generally where the first floor elevation is lower than the street this will be required.

d. Sewer service laterals shall be designed for a minimum of four (4) feet of cover at the building foundation. Insulation will be required should the sanitary sewer lateral be less than the required four feet deep. Under no circumstances will the use of insulation be installed without the authorization of the City of Concord's Representative.

6. SEWER SERVICE PIPE MATERIALS

Allowable materials for Sanitary service connections:

- PVC-SDR 35
- PVC-SDR 26
- Ductile Iron
- Cast Iron

B. CONSTRUCTION REQUIREMENTS

1. PIPE ORIENTATION

All pipe utilizing Bell and Spigot joints shall be laid with the spigot end downstream. Bells will not be permitted in structures.

2. EQUIPMENT

The contractor must provide qualified operators and the appropriate equipment properly maintained to perform the various construction operations.

Excavation shall be accomplished by methods that preserve the undisturbed state of the subgrade soils. A trench may be excavated by machinery to the designated subgrade, provided that the bottom of the trench remains in the undisturbed state and provides the proper foundation for the pipe bedding.

Equipment may have to be modified by welding a blade to the bucket teeth to achieve the required shape to fit the lower 1/3 of the pipe exterior for pipe 36" in diameter and larger.

3. BEDDING

PVC sanitary sewers and laterals shall be installed in accordance with ASTM D2321-89. Contractor shall use ¾" crushed stone for bedding and haunching and at a minimum of 6" below the pipe to the top of the pipe. However, should the contractor choose to use other material for bedding and haunching, the requirements of ASTM D2321-89 must be certified; i.e., soils classifications, soils compaction testing, etc. Any deviation from this requirement shall be approved by the City Engineer.

Crushed stone bedding shall be placed a minimum of 6" beneath the pipe throughout the excavated trench bottom in sanitary sewer main installation. Crushed stone shall be standard ¾ inch stone as detailed below:

Screen size	% Passing
1"	100
3/4"	90-100
1/2"	15-55
#10	0-5

B. CONSTRUCTION REQUIREMENTS (continued)

4. PERMITS

A **Street Excavation Permit** and possibly an **Encumbrance Permit**, available from the Engineering Services Division will be required for all work within the City of Concord's Right-Of-Way. The DIG-SAFE Request Number is required on the Street Excavation Permit. The contractor shall complete the work in a manner that will cause the least inconvenience to the general public. The cost of all permits can be found in Appendix A – Fee Schedule.

Prior to the issuance of the Street Excavation Permit, the Contractor shall furnish an original copy of a $1,000,000.00 Liability Insurance and a said bond amount requested by the Engineering Services Division. The proof of insurance and bond amount must be submitted at the time of the permit request.

It should be noted that, the bond amount will be held for a two (2) year period in case any workmanship deficiencies arise within the City of Concord's Right-of-Way.

The permits are a formal agreement for which the contractor assumes all responsibility and liability resulting from their activities within the public right-of-way.

C. INSPECTIONS AND TEST REQUIREMENTS

The Engineering Services Division's representative will make inspections to assure that the sanitary sewer work conforms to City standards.

1. VISUAL INSPECTIONS

Visual inspections are normally required to confirm the hydraulic integrity of sanitary sewer systems. Pipelines are required to be true to alignment and at a uniform slope between structures. "Ponding" or deviations in alignment will be cause for rejection, (see Pipe Sag Limit D-12). The Engineering Services Division shall determine if the ponding or deviations in alignment are cause for rejection during the review of the sanitary sewer video prepared by the Contractor (See Item #6, Video Camera)

2. LOW PRESSURE AIR TESTING

Low pressure air testing has proven to be an efficient means of testing sewer lines for leaks. This test may be performed by an independent testing agency after notice to the City Engineer or their designee. Should the contractor conduct their own test, an Engineering Services inspector must be present to witness the results.

Test Requirements: The sanitary sewer main between structures, including laterals and all connections, regardless of length, must hold a positive pressure of 4 PSI over a period of 5 minutes with no less than a 1 psi of pressure loss.

Testing of minor sewer service repairs may be accomplished by visual inspection where "air" and "hydraulic" methods would be impractical.

3. HIGH PRESSURE AIR TESTING

All sanitary sewer force mains shall be tested for air and water tightness. As with low-pressure air testing, sanitary force main pressure testing may be performed by an independent testing agency. All test results shall be submitted by the independent testing agency to The City of Concord's Representative for review.

Test requirements: The sanitary sewer main between structures, including laterals and all connections, regardless of length, must hold a positive pressure. Pressure for testing force mains should be a minimum of 40 PSI or higher as calculated according to the following formula: HEAD x 1.5 (safety factor) / 2.31 ft/lb = pressure/sq. in - See Force Main Testing Detail #4.

4. WATER TESTING

Testing requirements shall be the same as those established by New Hampshire Water Supply and Pollution Control Division and described in Sections Ws 7l3.03 (b) and (c) of Standards of Design for Sewerage and Waste Treatment Systems set forth by the New Hampshire Department of Environmental Services.

5. DEFLECTION TESTING

Deflection tests are required for all flexible pipe (ductile iron and concrete pipe are not considered flexible). Deflection tests will be conducted a minimum of 30 days after installation of pipe and after the road has been sub-graded and ready for select materials. Deflection tests shall be performed on the entire length of the sewer main line on a manhole-to-manhole basis. The go, no-go mandrel test method shall be used and not performed before all utilities have been installed. Maximum deflection shall not exceed 5% of the pipe's internal diameter.

6. VIDEO CAMERA

All pipelines will be subject to the scrutiny of a video inspection prior to acceptance to assure proper jointing and flow characteristics. The video shall be submitted to the City of Concord's Representative for review and comments.

Camera inspections will not be scheduled until construction of other utilities in the same area is completed and the pipeline under consideration has been backfilled and compacted to subgrade elevation.

All structures are to be accessible to the video inspection vehicle and all pipelines shall be cleaned of all debris prior to the inspection. The presence of debris or insufficient flushing water will necessitate re-inspection following correction.

Video camera inspections will be performed after flushing the sanitary sewer main or lateral with water containing a visible dye and allowed to drain. Any resulting ponding cannot exceed the allowable limits as outlined in the **"Sag Table Detail #12"**. EXCESSIVE PONDING OR ALIGNMENT DEVIATION DEEMED BY THE CITY OF CONCORD'S REPRESENTATIVE IS CAUSE FOR REJECTION.
ALL COSTS ASSOCIATED WITH THE VIDEO INSPECTION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

C. INSPECTIONS AND TEST REQUIREMENTS

7. VACUUM TEST

The vacuum test method is the preferred method to insure manhole integrity; however, water exfiltration testing is an acceptable alternative. The test criteria require a sealed manhole to hold a vacuum drop of one inch of mercury over a given number of seconds for acceptance.

The initial test pressure is to be negative 10-inches of mercury. Maximum allowable test time for a 1-inch loss in pressure from negative 10-inches of mercury to negative 9-inches of mercury is 120 seconds for a structure up to ten (10) feet deep (as measured from the floor of the structure to the top of the precast unit). For structures measuring over 10 feet and up to l5 feet deep 150 seconds are allowed. Structures over 15 feet and up to 20 feet deep require up to 180 seconds for acceptance. Structures over 20 feet and up to 25 feet deep require 210 seconds without a 1-inch total loss of vacuum.

8. WATER EXFILTRATION TEST

Water exfiltration test procedures for 4'-0" or 5'-0" diameter manhole structures are as follows:

The manhole pipelines shall be plugged and the structure filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage on the outside of the structure, the manhole structure shall be considered satisfactorily watertight. If the test as described above is unsatisfactory, as determined by the City of Concord's Representative, or if the manhole structure has been backfilled, the test shall continue.

A period of time shall be required for absorption. After absorption, the manhole shall be refilled to the top of the cone section and a measuring time of 8 hours begun. At the end of the test time, the manhole shall be refilled to the top of the cone section, being careful to measure the volume of water added. This amount shall be converted to the 24 hour rate per vertical foot of depth.

The rate is not to exceed 1 gallon per vertical foot for a 24 hour period. If the test fails this requirement, repairs by approved methods or total reconstruction of the manhole structure may be ordered by the inspector to bring the leakage within the allowable limits.

C. INSPECTIONS AND TEST REQUIREMENTS (Continued)

WATER EXFILTRATION TEST

8-hour exfiltration test for 4'-0" diameter or 5'-0" diameter manholes:

STRUCTURE HEIGHT	GALLONS ALLOWABLE LEAKAGE	MAXIMUM WATER DROP ALLOWED IN 30 INCH OPENING	
		FEET	INCHES
4’	1.3	.0354	3/8
5’	1.7	.0463	1/2
6’	2.0	.0545	5/8
7’	2.3	.0626	3/4
8’	2.7	.0735	7/8
9’	3.0	.0817	1
10’	3.3	.0899	1-1/8
11’	3.7	.1008	1-1/4
12’	4.0	.1089	1-3/8
13’	4.3	.1171	1-1/2
14’	4.7	.1280	1-5/8
15’	5.0	.1362	1-3/4
16’	5.3	.1444	1-3/4
17’	5.7	.1553	1-7/8
18’	6.0	.1634	2
19’	6.3	.1716	2-1/8
20’	6.7	.1825	2-1/4

D. MASONRY CONSTRUCTION

Certificates of Compliance shall be submitted by the Contractor for each material to the City of Concord's Representative for review and approval.

1. MATERIALS

a. Brick: Brick shall be solid, sound, hard, and have plain or smooth surfaces on both ends and on the face side, and be satisfactory to the City Engineer. Brick shall comply with A.S.T.M. Standard Specifications for Sewer Brick, Designation C32, for Grade SS, Hard Red Brick. Brick samples will be required for approval prior to incorporation in the work.

b. Cement: Cement shall be straight **Portland Cement**, Type I, II, or a Type I/II. Lime mortar or Masonry cement is not to be used on structures.

c. Sand: Sand shall be a **washed** masonry or concrete sand, and must conform to A.S.T.M. Designation C33 as follows:

Sieve Size	Percent Passing (by weight)
No. 8	100
No. 16	60 to 100
No. 50	15 to 35
No. 100	2 to 15
No. 200	0 to 5

d. Portland Cement Mix: Mix shall be composed of 1 part Portland cement, 2 parts of **processed** sand, and **potable** water to produce a consistency of stiff paste.

The mix shall be thoroughly blended only in such quantity as may be required for immediate use, and shall be used before the initial set has taken place. The mix shall be constantly worked over with hoe or shovel to keep it workable. Adding water after mixing to bring a hardened mix "back to life" will not be allowed.

e. Brick masonry: Brick masonry shall be protected from too rapid drying by approved means and shall be protected from weather and frost, as required. Bricks shall be laid in a full bed and joint of mortar without requiring subsequent grouting, flushing, or filling. Joints between bricks shall not exceed 3/8 inch and shall be tooled flush to the brick surface.

Brick masonry during winter conditions must be protected from freezing. A suitable heated shelter will be required to assure all materials remain above freezing for 3 days.

D. MASONRY CONSTRUCTION (continued)

2. INVERTS

Manhole inverts shall be constructed to provide an uninterrupted flow channel and shall correspond in shape to the lower half of the pipe. Brick shall be laid on edge as shown in Detail #10.

Mortar joints shall be tooled flush to the face of the brick to prevent minor depressions. Shelves shall be constructed to the midpoint of the pipe size ranging from 8-inches to 15-inches and to the highest pipe crown on larger pipe diameters. The brick shelf shall be pitched to drain toward the through channel with one inch of difference from the structure wall to the channel edge. Puddling or undue turbulence through the manhole trough will necessitate reconstruction (See Detail #10).

The use of fiberglass inverts may be allowed per the authorization of the City Engineer. The contractor shall submit the manufacturer's shop drawings and other pertinent information as needed to the City Engineer for review and approval.

Only solid masonry construction will be accepted under the brick shelf.

3. ADJUSTING FRAMES TO GRADE

Frames shall be centered over the manhole opening and to be set no less than a 1/8-inch for manhole frames and covers, and catch basin frames and grates to be set no less than 1/4-inch below finished pavement grade. A minimum of 2 courses of brick are required under the structure frame, yet the adjusting course shall not exceed approximately one foot of brick - (normally 5 course maximum). One course of brick may be laid on edge. Brick and Portland cement mix is the only masonry material to be used between the precast structure and the cast iron frame. The use of barrel blocks and concrete grade rings is not permitted. *All frames, grates and covers shall be designed to handle H20 Loading.*

4. MASONRY REPAIRS

All work on existing facilities shall be performed by or under the direction of City forces.

Only sound masonry materials shall be incorporated into the work, and any necessary repairs must first be approved by the City of Concord's Representative, and observed prior to backfilling.

V. STORM DRAIN SYSTEMS

A. MATERIALS

Certificates of Compliance shall be submitted by the Contractor for each material to the City of Concord's Representative for review and approval.

1. REINFORCED CONCRETE PIPE

a. Conformance to standard specifications: The minimum pipe inside diameter for storm drain systems accepting roadway run-off shall be 12-inches. The use of pipe smaller in diameter than 12-inches is not permitted. Pipe shall conform to the standard specifications for reinforced concrete culvert and storm drain. Pipe shall be **Class IV 3000D** typically or **Class V 3750D** when required due to extra depth or loading.

b. Gasketed pipe joints: Gasketed pipe joints are required for all City installations and shall conform to **A.S.T.M. Specification C443** for Joints on Circular Concrete Storm Drain and Culvert Pipe Using Rubber Gaskets.

c. Fittings and accessories: Fittings and accessories must be approved by the Engineering Services Division prior to installation.

d. Storage and handling: Storage and handling of drainage pipe shall meet the same requirements as for sanitary sewer pipe (see Sanitary Sewer, Section A, 3.a).

2. HIGH DENSITY POLYETHYLENE PIPE (HDPE, ADS, etc.) – This product cannot be used within the City of Concord's Right-of-Way.

This product must be designed for the intended application and should it be proposed for traffic load conditions it must meet H-20 live load requirements. The manufacturer must recommend the product for:

a) Closed main-line storm drain systems.
b) Open-ended culvert installations utilizing concrete headwalls. Smooth Interior Corrugated Polyethylene Pipe must meet or exceed the following requirements:

a. Gasketed pipe joints: A watertight joint must meet or exceed concrete pipe standards ASTM C924, C969, and C1103. The pipe system must utilize a bell and spigot type joint design or a solid collar system to eliminate displacement and deformation at the joint. Joint integrity must meet ASTM Designation: D-3212.

b. Compatibility: Concentric corrugations or a smooth exterior is necessary to mate the pipe to concrete structures utilizing neoprene boot systems that maintain a watertight seal.

c. Fittings: Manufacturers fittings for lateral services must meet the City's current water tightness standards.

d. Testing: Deformation testing will be required and must not exceed five per cent (5%) of the inside pipe diameter in any axis.

e. HDPE Pipe used on private installations only and must meet all the City's current concrete pipe standards for water tightness and sanitary sewer standards for roundness. Where a private drain line may cross the City of Concord's Right-of-Way, there shall not be a combination of two different products such as the use of concrete and HDPE. The entire drain line shall be constructed of either RCP or SDR.

f. Handling: Pipe must be moved and stored as flat and level as practicable.

3. POLYVINYL CHLORIDE (PVC) PIPE

a. Pipe and fittings shall conform to ASTM D-3034 and shall be SDR-35 or SDR-26. Joint compression rings shall be of an oil resistant rubber type, elastomeric seals conforming to ASTM D-3212, or flexible elastomeric seals conforming to ASTM 3212.

b. For use in culvert installations concrete headwalls are required.

HIGH DENSITY POLYETHYLENE & PVC PIPE used in conjunction with concrete masonry structures may require special treatment to assure a watertight seal. Manufacturer's recommendations must be followed to assure long-term performance.

4. STRUCTURES

a. Catch basins: Eight inch (8-inch) walled, reinforced concrete structures are recommended when tying into existing structures and five inch (5-inch) wall reinforced concrete structures are required for new construction. The structures shall be designed to handle H20 Loading.

For five-inch thick, reinforced structures, a neoprene boot to securely seal the pipe stub in the opening is preferred. If booting cannot be done due to trench constraints, a **sand stub** may be utilized to provide a secure seal.

Eccentric or Concentric conical top sections are required as illustrated on the standard details. Slab top sections shall be used only when the distance from top of grate to top of pipe is less than 48-inches.

Every catch basin is required to have a 3-foot sump as measured from the outlet pipe invert to the floor of the structure. The sump shall be a solid precast unit. Should a center hole be cast in the base it must be plugged with Portland Cement Mix.

THE USE OF BARREL BLOCKS OR CONCRETE GRADE RINGS IS NOT PERMITTED FOR NEW CONSTRUCTION.

Catch basins shall be accurately located one (1) foot off the curb line for 4-foot I.D. structures to ensure that the frame will be flush to the curb and centered over the structure. In no case shall the frame and grate not be flush against the face of the curb. Shall the frame and grate not be flush against the face of curb; the Contractor/Developer will be responsible for re-setting the frame/grate and or the entire structure to achieve the proper placement.

a. Catch basins – continued: Although catch basins may not be required to be tested for water tightness, infiltration is not acceptable.

Should site conditions require modifications to structure openings, only methods approved in advance by the Engineering Services Division such as core drilling or sawing will be accepted.

All PVC pipe connections to structures (such as under-drain and footing drains) must be cored and booted to assure a secure seal.

b. Frames and grates: Cast iron frames shall be N.H.D.O.T. Standard catch basin Type B with alternate-1 grate for roadway slopes equal to or less than 5%, as show on the detail of the New Hampshire Standard Plans for Road and Bridge Construction, Standard DR-1, Plate 2. All castings shall be North American made and be designed to handle H20 Loading. The use of India castings is not permitted.

Where roadway slopes are equal to or greater than 6%, N.H.D.O.T Type-F, "Bicycle Safe" frames and grates shall be installed as show on the detail of the New Hampshire Standard Plans for Road and Bridge Construction, Standard DR-2, Plate 1. All castings shall be North American made and be designed to handle H20 Loading. The use of India castings is not permitted.

c. Drain Manholes: Drain manholes shall be of similar construction to catch basins with the exceptions that:

1) Brick inverts for all drainage pipes shall be constructed to sanitary sewer standards with the exception that the brick invert will only be constructed to the midpoint of the pipe as shown on Detail #10.
2) A 30-inch opening for a top section is required.
3) New Hampshire Standard Manhole frame and cover as shown in the New Hampshire Standard Plans for Road and Bridge Construction, structures shall be designed to handle H20 Loading, Standard DR-2, Plate 2, is required.

d. Underdrain: Underdrain, if not detailed on the approved plans, may be required should site conditions warrant. Seasonal high water table must be kept to a minimum of 2-feet below subgrade across the roadway section. Should the water table be encountered during subgrade preparation, an appropriate engineering solution must be submitted for approval to correct the situation.

PVC pipe meeting SDR-35 or SDR-26 requirements or other straight pipe designated for roadway underdrain of a 6-inch minimum diameter is acceptable. Coiled slotted house foundation underdrain or corrugated metal underdrain is not permitted for roadway construction.

Underdrain shall be bedded in crushed stone wrapped in the appropriate geotextile fabric as shown on Detail #54.

All daylighted underdrain shall have a either a pre-cast concrete headwall or a masonry headwall along with a rodent proof end grate installed at the outlet.

B. CONSTRUCTION REQUIREMENTS

1. STORM DRAIN SYSTEMS:

a. Storm drainage systems must meet the same general requirements for construction as described for sanitary sewers. All storm drain manholes shall have brick inverts. The shelf shall be constructed to the midpoint of the pipe on diameters ranging from 4-inches to 15-inches and to the crown on of the pipe for diameters greater than 15-inches.

The brick shelf shall be sloped to drain runoff towards the invert with a one inch difference from the structure wall to the invert edge (See Detail #10). Any ponding or undue turbulence within the drainage invert will necessitate reconstruction of the invert to correct the problem. Crude methods for grade and alignment control will not be allowed; such as the use of line levels, carpentry levels, hand levels, batter boards, string lines or "by eye".

b. Proper catch basin location is essential to assure compatibility with finished roadway curb and structure installations.

c. Crushed Gravel or Granular Backfill is required under the load bearing section of all storm drain pipe as site conditions warrant from the undisturbed stable soil to the mid-diameter of the pipe.

Granular fill over the pipe may be required should the excavated material be too "bony" and threaten to injure the pipe.

d. Should unsuitable soils be encountered in the excavated trench all material will be removed and replaced with granular fill to the limits as directed by the City Engineer.

e. Standard drain structures shall be required at every change in vertical grade or horizontal pipe alignment.

2. Drain Laterals:

a. Storm drain service taps will be accomplished using a “Tee-Wye” connection at the main in accordance with the City of Concord’s Building and Plumbing Codes, and the International Plumbing Code, 2003 Edition.

b. Perimeter drain laterals (6-inch PVC) shall be bedded in ¾-inch crushed stone from the top of the pipe to 6-inches below the invert.

c. Drain clean outs for house service connections shall be installed at the building foundation or as directed by the City of Concord’s Representative.

d. Perimeter foundation drains shall be PVC SDR 35 or PVC SDR 26.

e. Building foundation drains that discharge to daylight shall have a rodent proof end grate installed at the out-flow end of the pipe along with a pre-cast concrete headwall or a masonry headwall.

f. Should a building foundation perimeter drain discharge near a pond, stream bed, or an area subject to flooding then a check valve shall be installed before the outlet.

2. Drain Laterals (continued):

h. Shallow drains (less than 4-feet of cover) may require frost protection should they cross under paved areas. In no case, shall insulation be placed without the permission of the City of Concord's Representative.

i. For sump pump installations: 1-1/2-inches or 2-inches - polyethylene pressure pipe can be used to carry ground water from the foundation drain.

j. A cast iron cleanout box with a cover marked "drain" is required over 6-inch drain cleanouts - see Detail #1 and #2.

3. INSPECTIONS AND TEST REQUIREMENTS

a. VISUAL INSPECTIONS

Visual inspections of drain pipe will be performed to assure proper installation. Pipelines are required to be true to grade and alignment from structure to structure. Pipe must be sound and flawless. Cracked, chipped or deformed pipe must be replaced.

b. INFILTRATION

Storm drain systems are inspected for infiltration visually and by video camera. Should infiltration be observed, (other than minor wetness), repair or replacement will be required.

c. OBSERVATION FOR UNIFORMITY OF FLOW

Water used to flush lines will be observed for uniformity of flow through each pipeline from structure to structure.

d. DEFLECTION TEST

Deflection test will be required on all flexible pipes. Concrete and Ductile Iron are considered to be rigid pipe.

e. VIDEO INSPECTIONS

All City of Concord maintained storm drain systems including service laterals must pass video camera inspection prior to acceptance. The video shall be submitted to the City of Concord's Representative for review and comments.

ALL COSTS ASSOCIATED WITH VIDEO INSPECTION SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

4. PONDS, SWALES AND MISCELLANEOUS DRAINAGE TREATMENT

a. SLOPE STABILIZATION

Maximum slopes for earthen structures intended for vegetation shall be 3:1. The use of slope stabilization products for slopes equal to or greater than 3:1 such as Geotextile fabrics or other approved alternatives are strongly encouraged in lieu of stone rip-rap where conditions permit.

Shall the contractor request the use of stabilization products in lieu of stone rip-rap as shown on the approved design plans, the contractor shall contact the design engineer for the project and a written letter describing the proposed geotextiles and the stability of the slope using the proposed product, shall be submitted to the City Engineer for review.

b. RIP RAP REQUIREMENTS

Where indicated or required to stabilize a particular slope or water course, rip rap shall consist of: approved quarry stone, or broken rock of a hard, sound, and durable quality, reasonably free of thin or elongated pieces; and graded accordingly as shown on the approved design plans and in accordance with the Stormwater Management and Erosion and Sediment Control Handbook for Urban and Developing Areas in New Hampshire, New Hampshire Department of Environmental Services, latest edition.

If the approved design plans do not indicate the type of stone, the size, etc. for the slope or pipe outfall to be stabilized, the contractor shall contact the design engineer to determine the proper material and size to be used. The information shall be supported by type of design storm, design method, piping system, etc. All information shall be submitted to the City Engineer for review prior to the placement of the material.

c. SAFETY BARRIERS

Should perimeter fencing be required as shown on the approved design plans where hazardous conditions are identified, a 6-foot minimum height fence with a 14-foot access gate shall be constructed, using standard chain link fabric.

VI. WATER SYSTEM INSTALLATION

A. STORAGE OF WATER PIPE FITTINGS

1. Prior to the storing of water pipe on the job site, the City of Concord's Representative **shall be notified at least 24 hours in advance** as to when pipe and fittings will arrive. Upon arrival, Engineering Services will visually inspect the pipe for class rating and evidence of mishandling. Prior to the delivery, the contractor shall submit the Certificate of Compliance to the City of Concord's Representative for review.

   After approval of the pipe and fittings, the contractor shall be required to provide a watertight seal at both ends of the pipe, with a minimum of 1.5 mil polyethylene plastic wrap. This shall be accomplished using sheet plastic or bags secured with duct tape.

2. All pipes shall be stacked on 4" x 4" timbers in tiers with chocks nailed at each end to prevent movement of the pipe. A maximum allowance for stacking height is included in the detail section according to pipe size (See Detail #14).

3. Loader forks are allowed for the unloading and stacking of pipe provided it is done with care. If pipe hooks are used in the ends of pipe for unloading purposes, they should be of special shape and padded so as to fit either the plain or bell end without damaging the pipe lining. Lifting chains will not be allowed in place of pipe hooks due to safety precautions.

4. Moving the pipe from the stacked pile to the trench by loader using forks or approved hooks is acceptable provided it is done with care. The pipe may not be strung along the ditch line until Engineering Services has reviewed and approved the locations.

B. LAYING WATER PIPE

1. **Water pipe must be bedded on a 6-inch sand cushion:** and covered with a minimum 12-inch layer of compacted sand – no stones. Where unsuitable/unstable material is encountered below pipe grade it will be removed and replaced with crushed stone or suitable gravel fill below the sand bedding as directed.

2. **Laying depth must be 5 feet 6 inches (5.5-feet) compacted:** from the top of the pipe to the finished grade of the proposed roadway. Where extra depth may be required at utility crossings the pipe must return to the specified laying depth by the use of fittings as directed by the Engineering Services Division. In no case will the pipe depth be allowed in excess of 6-feet at water main valves.

B. LAYING WATER PIPE (Continued)

3. The Contractor will be responsible for pipe grade to insure that the depth of cover to finish grade will be a minimum of 5-feet 6-inches and a maximum of 6-feet, unless grade conflicts require a variance from this requirement. If a proposed water main location conflicts with a utility, the use of a "ductile iron offset" shall be used.

   The use of insulation installed over the top of the pipe when the required depth cannot be achieved, will not be permitted without the approval of the City of Concord Representative.

4. Joint deflection of ductile iron pipe is acceptable provided the pipe is assembled in a straight line, both horizontally and vertically, before the deflection is made. With mechanical joint fittings, bolts should be partially tightened before any deflection is made (See Pipe Deflection Detail #17).

   When joining ductile iron pipes together; first, the pipe must be set in proper alignment. Mechanical equipment may be used to push the pipe into the bell socket only after a 4" x 4" block of wood is held against the bell end of the pipe.

5. **Water mains must be separated from storm drain systems** for frost protection. Should the separation be less than 3 feet from a storm drain manhole, catch basin, or pipeline; 2" rigid polystyrene thermal insulation with a minimum "R" value of 11 will be required and a distance to be specified by the City of Concord's Representative, (a standard minimum of 8' is required). The City of Concord's Representative shall be contacted prior to the installation of the insulation.

6. State regulations require water mains to be separated from sanitary sewer mains by a minimum of 10-feet (horizontally).

7. Should a sewer main cross a water main, the sewer must be replaced with ductile iron pipe for a minimum distance of 9-feet in each direction or until the required separation is achieved. Pipe joints shall not be located within 9 feet of the crossing. A minimum of 18-inches vertical separation shall be maintained at all crossing.

NOTE:
SEVERAL ADDITIONAL SETBACKS SHOULD BE CONSIDERED WITH RESPECT TO THE PROPOSED WATER MAIN. PLEASE REFER TO THE NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES FOR THE SETBACK REQUIREMENTS.

B. LAYING WATER PIPE (Continued)

8. No trench shall be left open at the end of the workday. Contractor shall take all the necessary precautions to "button-up" the work zone for the general public during the night. Precautions include but not limited to, placing steel plates over the trench, barricades, lighting, signs, etc. Contractor shall contact the City of Concord's Representative before leaving the site at the end of the day, to ensure that work zone has been adequately closed up for the safety of the public.

9. A **"watertight plug"** must be inserted as each length or fitting is installed. This "end plug" will be left in place at the end of the workday.

10. Detectable "Water" marking tape shall be installed 12-inches above the crown all newly installed water mains.

11. Water mains, including any close proximity utilities such as gas, sewer, etc, shall be exposed by the contractor prior to directional boring/drilling and or jacking. Prior to any directional boring/drilling and or jacking, a fully detailed plan showing the proposed construction activity shall be submitted to the City Engineer for review at least two (2) weeks prior to the commencement of the construction activity. The proposed sleeve shall consist of either steel or SDR 11 and traceable wire shall be placed over the utility.

C. MECHANICAL FITTINGS AND ACCESSORIES

1. Fittings, valves and fire hydrants must be stored off the ground so they will not collect moisture or be damaged.

2. Retaining glands, tie rods or a combination of poured concrete thrust blocks and retainers must be used on all mechanical fittings. A chart pertaining to thrust block sizing is attached. A durable flat surfaced rock may be substituted should it possess adequate bearing area against undisturbed earth. If tie rods are used, they shall be coated with an approved rust proofing agent.

3. A torque wrench must be used on all fittings to insure manufacture's recommended torque.

Generally accepted Torques:

70 lbs. on set screws
75-90 lbs. on glands with 3/4" - (19)mm bolts
60 lbs. on glands with 5/8" - (16)mm bolts

4. **ASSEMBLY INSTRUCTIONS for Ductile Iron Pipe:**

Clean bell and spigot end and lubricate gasket with approved pipe lubricant. Set gasket into position to assure even seating in the bell. When gland is in position, insert bolts and tighten with fingers. Tighten bolts to the normal range of bolt torque while maintaining approximately the same distance between the gland and the face of the socket. A proper joint is accomplished by partially tightening the bottom bolt first, then the top bolt; next the bolts at both sides; and finally the remaining bolts. Repeat this process until all bolts are within the appropriate torque range.

C. MECHANICAL FITTINGS AND ACCESSORIES (Continued)

5. All main line valves at pipe intersections (including hydrant valves) are to be placed within 2-feet of the tees.

6. Large valves (10-inches or greater) must be supported with blocking to prevent the pipe from supporting the valve's weight during installation.

7. Install valve boxes with a cushion of sand between the valve and the valve box. A Gate Box Aligner shall be required under the operating nut - (See Detail #15). In wet areas, washed stone is to be placed around the valve box with a layer of hay or a geotextile fabric to prevent fine soil from mixing with stone during initial backfill.

8. Exercised each valve in the presence of the inspector. The number of turns must be recorded before the valve is installed.

9. Stainless steel tapping sleeves are acceptable.

10. A contractor installing a new or larger water service shall be responsible for properly discontinuing the abandoned service connections. The contractor shall not disconnect any service connections without the proper authorization from Engineering Services.

    Discontinued service connections are normally retired at the water main. A copper service can be cut and capped at the property line should circumstances exist where access to the water main is impracticable. Discontinued service connections of lead or iron piping shall be abandoned at the water main.

11. No contractor will operate City valves or curbstops without the explicit permission of the City.

12. Unauthorized usage of City water carries a minimum $1000.00 fine. Unauthorized usage includes the installation of a hose for dust control off of a hydrant. The Engineering Services Division will report the incident to General Services and the Contractor shall be fined.

D. HYDRANTS

1. Hydrants are to be installed at the proper depth and a concrete slab or large flat rock is to be used to support the hydrant's weight. Use of a level to assure proper alignment is required. Hydrant extension kits will be required for height adjustments to assure the proper break point, visibility, and accessibility of the hydrant.

2. The Contractor shall be responsible for hydrant painting. Requirements for hydrant painting are included in Detail #16.

3. Hydrants located further than 20-feet from the water main will require an 8-inch feed.

4. Contractor is responsible for the installation of the “marker flag” as show on the hydrant detail.

E. SERVICE LINES

1. Corporations will be installed at either the two o'clock or the ten o'clock position on the pipe circumference.

2. An (**S**) loop must be provided in the tubing nearest the corporation, and set no higher than the water main.

3. Any service longer than sixty feet from the main to the curbstop must be a minimum of one-inch diameter to provide for adequate flow.

4. Saddles are required for service taps over 3/4" on 6" diameter mains and smaller; and double strapped saddles with a CC (AWWA) thread is required for service taps over 1" on mains larger than 6" diameter.

5. Curb valves will be set on the Street Line in City Streets. If curb box extensions are needed, no more than one (1) - 12" galvanized or black iron nipple with coupling will be allowed. The maximum depth for curb valves is 6 feet.

6. Curb boxes shall not be set in driveways or walkways unless field conditions do not permit the installation. The City of Concord’s Representative shall be contacted if the requirement cannot be met prior to the installation.

7. Service lines and sprinkler system lines may be laid in the same trench with sewer service laterals as long as the water line is 18" above and 36" to either side of the sewer service with a minimum cover of 5 feet. If this can not be accomplished, State regulations require a 10-foot separation between water and sewer.

8. Adjacent curb boxes must be set at least 4-feet apart.

E. SERVICE LINES (continued)

9. Minimum distances for service lines:

From an underground utility shall be: **5**-feet
From a septic tank shall be: **10**-feet
From a leach bed or dry well shall be: **25**-feet

10. Water service pipe through foundation walls or floors:

Clearance shall be provided around all water service pipe passing through foundation walls or floors to protect against: chemical action from direct contact with concrete; distortion or rupture from shearing action due to settlement; expansion, contraction, or abrasion from vibration. Clearance shall not be less than 1/2 inch between the pipe and wall. Plastic or steel sleeves may be used to provide for the wall opening. The void between the pipe and the wall or floor slab (from the outside through to the inside) shall be sealed with an approved vermin resistant, waterproof, flexible, permanent sealant.

11. Insulation items apply:

The minimum depth of the water service shall be 5-1/2-feet. Should the water service line be less than 5-1/2-feet deep, two-inch thick rigid polystyrene thermal insulation with a minimum "R" value of 11 will be required. Engineering Services shall be contacted prior to the installation of the insulation.

12. **All** service lines shall have detectable "Water" marking tape placed 12-inches over the crown of the line.

13. At the discretion of the City of Concord Representative, the service from the curb stop to the residence, can be air tested at 100-psi for 15-minutes or the use of static testing may be used as well.

F. MAIN LINE TESTING

1. The contractor shall provide all test corporations, ball valves, and blow-offs required for main line testing by the Engineering Services Division.

2. Fire hydrants shall be used as "blow-off valves", venting, etc. When field conditions do not allow the use of a fire hydrant, a blow-off valve (type and location) shall be determined by the City of Concord Representative; the contractor shall not install a blow-off valve without the proper authorization.

G. PRESSURE TESTING

1. A pressure test is required before any water supply main will be accepted. Water mains will not be tested during disinfection.

a. This test consists of pressurizing the water line to 150 psi (min) or 1.5 times the static pressure in excess of 100 psi **- not to exceed 200 psi**. The static pressure must hold for one hour to be acceptable. Services 2-inches in diameter or greater must be pressure tested.

b. The test will be performed by the Contractor or a reputable testing firm. A City of Concord Representative shall be present to witness the test. The test results shall be forwarded to Engineering Services or their consultant for review and acceptance.

H. DISINFECTION

1. All water mains greater than two inches in diameter must be disinfected. Disinfection shall be in accordance with the American Water Works Association (**AWWA**) standard **C651-86** (Disinfecting Water Mains). The contractor will use a liquid disinfectant to clean the pipeline. Engineering Services recommends a chlorine concentration of 100 ppm. An Engineering Services Inspector must be present to witness the disinfection and operate all city valves. The Contractor will take water samples for bacterial analysis to a State certified testing laboratory. The reports shall be directed to the Community Development Department – Engineering Services Division.

I. METERING

1. Temporary meters shall be required for City water use during construction. The Contractor must agree to adhere to City operational procedures. Seasonal requirements may apply such as a hydrant being pumped after each use in winter conditions. The contractor can be fined a minimum of $1,000.00 without the proper authorization from the City of Concord.

2. It is the responsibility of the owner/developer/contractor to install meter setter horns or flanges in which the City will place the permanent meter. The meter is supplied and owned by the General Services Department.

3. The General Services Department's policy concerning the number of City meters at any premise is as follows:

   a. For single units, residential or otherwise: or for multiple attached units such as townhouses: or for duplexes that have their own cellar or first floor space: **each unit shall have its own individual water service and City water meter.**

   b. For apartment or condominium type units within shared buildings, (which are either new or conversions), and when there is no common first floor space: the owner can choose to: 1) service each unit on an individual water line, or 2) service multiple units from one water line. In the former a City meter will be set for each unit, and an account will be established for those meters. In the latter one or more City meters can be set according to the owner’s wishes. If one City meter is desired then one account will be established for that complex.

I. METERING (continued)

c. The owner is not precluded from installing their own private meters downstream (after the City meter), for the purpose of splitting the usage to tenants; but the City of Concord, General Services Division will not provide individual billing.

d. Multiple billing accounts can be established for each unit. **$4.00** per month will be levied on each additional account after the first **City meter**.

e. Secondary City meters used to determine the usage for a specific purpose such as irrigation or other non-sewered consumption shall only be allowed for **"closed"** systems that do not have threaded fittings for hose connections. Secondary meters shall be installed in parallel, and will be charged an additional **$4.00** monthly fee.

4. Meters shall be placed where they will be easily accessible for reading and maintenance (See Detail #24) The General Services Department will install and seal the meter.

5. Prior to having the meter installed the following must occur:

a. Application for service made at the General Services Department *utility billing office* - 311 North State Street.

b. All fees and charges including Special Investment Fees if applicable are paid.

Water Investment Fee (WIF)
Sewer Investment Fee (SIF)

c. Final Inspection of the project by the Engineering Services Division. No water meter will be installed until all outstanding project related issues, if any, are addressed.

ENGINEERING SERVICES WILL NOT "SIGN-OFF" FOR A CERTIFICATE OF OCCUPANCY PERMIT UNTIL THE WATER METER IS INSTALLED AND ALL OUTSTANDING PROJECT RELATED (ONSITE AND OFFSITE) ISSUES ARE ADDRESSED.

J. BACK-FLOW PREVENTION DEVICES

1. Approved non-testable double-check backflow prevention devices will be required for residential use. Any American Water Works Association (AWWA) or University of Southern California (U.S.C.) approved dual-check is acceptable. Example: Watts #7, Hersey (BSG), Febco 810, Ford (Style H.H.A. or H.H.S.).

a. For cases of single family and attached townhouse residential units, dual-check devices or setters with dual-checks are required.

b. Non-residential or lawn irrigation system installations shall require either a testable **double-check (DCVA)** or a **reduced pressure principle (RP)** device. The Contractor is to contact the department, to arrange for a sanitary survey and/or site analysis for confirmation.

c. All water piping and fittings to the backflow device is to be copper, brass, or cement lined ductile iron pipe.

VII. MATERIAL SPECIFICATIONS

Certificates of Compliance shall be submitted by the Contractor for each material to the City of Concord's Representative for review and approval.

A. WATER MAINS

All materials coming in physical contact with drinking water must be certified to meet the **ANSI/NSF Standard 61** by either the Underwriters Labs (**UL**) or the National Sanitation Foundation (**NSF**).

1. DUCTILE IRON PIPE

a. Ductile Iron Pipe shall be Thickness Class 52 or Pressure Class 350 for all pipe diameters. Pipe shall meet, or exceed, current **AWWA C151** specifications for ductile iron water pipe.

b. Maximum length is twenty and a half (20 ½-feet) feet. Double cement lining, seal coating inside and bituminous outside coating shall meet, or exceed, **AWWA C104**.

c. Push-on joints conforming to current **AWWA 111**.

d. Pipe to be furnished complete with gaskets and lubricant.

e. Certificate of Compliance to the above mentioned specifications must be supplied with shipment.

2. GATE VALVES

a. All valves to be **mechanical joint**.

b. For sizes 3-inch through 12-inch, gate valves shall be required. Gate valves will be resilient seat with non-rising stem and conform to, or exceed, current **AWWA** specification C509. Valves are to be supplied with all accessories.

c. Direction to open – **RIGHT (coded red)**

d. Acceptable makes and models:

Clow - (F series)
Kennedy - (Ken-Seal)
Mueller G.V. (A-2360)
M & H (style 4067)
AFC-2500

e. Post indicator valves (resilient seat)
Direction to open – **LEFT**

3. LARGE VALVES

a. For valves larger than 12-inch, butterfly valves (valves shall have the same number of turns as a standard valve) or horizontal operating resilient wedge valves are required and must conform to or exceed current AWWA specification C504 unless otherwise approved by the City of Concord Representative. Valves are to be supplied with all accessories.

b. Direction to open – **RIGHT**

c. Acceptable makes and models:

Clow 4500
Henry Pratt Co. "Groundhog"
M & H 4500
Mueller Lineseal III
AFC-2500 series (horizontal operating)

4. FITTINGS

a. Fittings shall be gray cast iron or ductile iron with mechanical joints. Fittings and accessories shall conform to or exceed current AWWA C153. Compact ductile iron fittings meeting AWWA C153 are acceptable. Fittings to be new, unused, free from rust, coated, and cement lined.

b. Fusion-bonded epoxy coatings are accepted.

c. Ductile iron - Class 350.

d. Mechanical joints and accessories shall meet AWWA C111.

e. Double cement lining, inside seal coating and bituminous outside coating shall meet AWWA C104.

f. Restrained joints shall use Romac "Grip Ring / Meg-A-Lug" or approved equal.

5. VALVE BOXES

a. Base: 36-inch or longer to suit grade. No stacking of base sections is permitted.

b. Top: 5 1/4" x 24" or 26" with top flange - (Screw type is not acceptable).

c. Cover: marked "Water" supplied.

d. Two piece boxes are required.

e. Only North American Made valve boxes are acceptable.

B. WATER SERVICES

1. CURB BOXES

a. 5-1/2-foot curb box complete with 36" rod (single piece) and cover.

b. Perma Rod Box with arch pattern base. Number 3 cover with pentagon brass plug and quick-release thread.

c. Opens **Left** – 1/4 turn.

2. COPPER TUBING

a. Tubing shall conform to or exceed current ASTM specification B-88.

b. Sizes 3/4" and 1" American made type "K" soft in 60 or 100 foot coils.

c. 1-1/2" & 2" - American made type "K" soft in straight lengths or coils.

d. **No 1-1/4" services.**

e. 3" Cement Lined Ductile Iron may be substituted for 2" copper tubing.

3. BRASS FITTINGS – (For Underground Use)

a. Acceptable makes of fittings: ball valve, curb stops and plug type or ball valve type corporation stops with conductive compression connections:

Ford
Mueller
McDonald
Hays.

b. **"Stop and Waste valves" are not allowed.**

4. METER SETTINGS

a. 5/8" x 3/4" meter horn with backflow prevention device.

b. 1" meter horn with backflow prevention device.

c. Meter horns shall be isolated with full open valves per the City of Concord's Building and Plumbing Code Regulations and the International Plumbing Code, 2003 Edition.

d. Backflow prevention device (#7 Watts or acceptable dual-check) shall be installed on the downstream side of the meter horn.

e. **Laying length of meters:**

5/8" x 3/4" = 7-1/2"
1" x ---- = 10-3/4"
1-1/2"x - = 13"
2" x ---- = 17"
3" turbo x - = 12"4"
turbo x - = 14"

C. HYDRANTS

1. Acceptable makes and models:

A.P. Smith H205
Darling B62B
Clow Eddy F2640
Mueller Centurion 200
MET Hydrant 94

2. Features:

a. **DIRECTION TO OPEN - LEFT**

b. Breakable flange (Traffic model).

c. Valve opening 5-1/4".

d. Two 2-1/2" NST hose nozzles.

e. One 4-1/2" NST pumper nozzle.

f. Operating nut and nozzle caps - NS pentagon 1-1/2" flat to point.

g. Depth of trench - 6 foot.

h. Six inch mechanical joint connection with accessories for 7.10" O.D. ductile iron pipe.

i. **DRAIN HOLE SHALL BE PLUGGED**.

THE COMMUNITY DEVELOPMENT DEPARTMENT, ENGINEERING SERVICES DIVISION, RESERVES THE RIGHT TO REQUIRE A SAMPLE FOR EVALUATION OF ANY ITEM SUPPLIED. ALTERNATE ITEMS MUST RECEIVE PRIOR APPROVAL OF THE CITY ENGINEER.

VIII. ROAD CONSTRUCTION

A. CLEARING AND GRUBBING

The entire width between slope lines shall be cleared of all stumps, brush, roots, boulders, unstable material and trees not intended for preservation.

B. SUBGRADE PREPARATION

1. BLASTING OPERATIONS

a. **Slopes:** When blasting is required, the required slopes or configuration shown on the plans shall be produced in a safe and stable condition.

b. **Authority to prohibit blasting:** The City Engineer or their agent shall at all times have the authority to prohibit or halt the contractor's blasting operations if it is apparent that: through the methods being employed the required slopes are not being attained; or the safety or convenience of the public is being jeopardized.

c. **A pre-blast survey,** subject to Engineering Services review, will be required for all buildings within a 500-foot radius of the blast site. No blasting is to take place without an approved pre-blast survey.

d. **Seismic monitoring** for frequency and acceleration will be required should adjacent structures be threatened.

e. The contractor shall also comply to the **2004 Policy on Construction Practices in The City of Concord to minimize disturbance and damages.** In summary, this policy describes that the City Engineer has the authorization to instruct the contractor to monitor vibrations not only during blasting operations but also during intensive construction projects (i.e., deep roadway cuts in close proximity to homes, etc.) to minimize disturbances to the surrounding neighborhood. The City Engineer will enforce the guidelines from N.H.D.O.T. Standard Specifications for Road and Bridge Construction, 2002 Edition - Section #203 and #211.

2. UNSUITABLE MATERIAL

a. **Removal of unsuitable material:** Where excavation to the designed elevation results in a subgrade or slope of clay, peat, muck or other unstable material, the contractor shall remove the unstable material to the depth necessary to attain a solid foundation.

b. **Backfilling:** Backfilling shall be done with approved materials and shall meet the requirements for: sand, gravel, broken rock or any combination thereof.

c. **Rock fragments:** Rock fragments in fill shall be placed in layers not in excess of 2 feet. The lifts shall be placed in such a manner as to close all voids. Earth shall be placed in layers to the full width of the roadway, generally parallel to the finish grade. The layers shall not exceed 12-inches of loose depth. Each layer shall be spread to a uniform thickness and compacted to the required density. Continuous grading or shaping shall be carried out concurrently with the compactive effort to assure uniform density throughout each layer of material.

C. BASE MATERIALS

1. APPLICATIONS

Prior to the placement of any road base material, all underground utility crossings shall be accomplished, with trenches properly compacted.

2. BANK RUN GRAVEL

a. Requirements: Bank Run Gravel shall meet the requirements of NHDOT Item #304.2; the gradation for the material is shown below:

Sieve Size	% Passing
6-inch	100
No. 4	25 - 70
No. 200	0 - 12

b. Maximum stone size: Maximum stone size shall be 6-inches in any dimension for a 12-inch compacted lift.

c. Oversized stones: Large stones removed from the gravel box may be used for slope fill when properly placed.

3. CRUSHED GRAVEL

a. Gradation for crushed gravel: Crushed Gravel shall meet the requirements of NHDOT Item #304.3; the gradation for the material is shown below:

Sieve Size	% Passing
3 Inch	100
2 Inch	95 - 100
1 Inch	55 - 85
No. 4	27 - 52
No. 200	0 - 12

At least 50% of the material retained on the 1-inch sieve shall have a fractured face.

b. Application: Crushed gravel shall be placed after the Bank Run Gravel course has been thoroughly compacted. Crushed Gravel shall not be placed until an independent testing laboratory has performed density testing on the Bank Run Gravel and the material meets or exceeds a density of 95% (See Item #4, under "Test Requirements". Crushed Gravel shall be placed in lifts not to exceed 12-inches in depth. It shall be shaped true to the grade and cross-section as shown on the typical section.

C. BASE MATERIALS (continued)

c. Compaction: Compacting of subgrade, gravel and or crushed gravel shall be accomplished with an approved vibratory roller. The materials shall be compacted and rolled until the density requirements are met. When vibratory equipment is being operated, the amplitude of vibrations may be adjusted as necessary to avoid causing damage to adjacent buildings and property.

4. TEST REQUIREMENTS

a. Density testing: The density of the subgrade material, Bank Run Gravel, and or Crushed Gravel shall be determined by AASHTO T191 (Sand Cone Method), or AASHTO T238 and T239 (Nuclear Methods). The density shall be not less than 95-percent (95%) of the minimum density determined in accordance with AASHTO T180 (Modified Proctor Density), and performed at a minimum of 300 ft between tests. Nuclear density methods will be governed by ASTM D2922.

b. Testing prior to placement of pavement: All testing shall be performed prior to the placement of any pavement. All test results shall be submitted to the City of Concord's Representative AT LEAST 24-HOURS IN ADVANCE OF THE PAVING OPERATIONS.

c. Testing at contractor's expense: All testing required by the City Engineer shall be done at the contractor's expense and by an approved testing agency.

d. Contaminated material: Previously tested and accepted materials contaminated by earthen, organic or other foreign material or degraded by hauling equipment to such an extent that the material ceases to meet the requirements, shall be removed and replaced.

D. PAVEMENTS

1. BASE COURSE

a. Asphalt Binder/Base course materials: Base course materials shall conform to the specifications in Section 401 of the N.H.D.O.T. Standard Specifications, 2002 Edition, for Type B (3/4-inch aggregate) pavement.

b. Placement of base course: Placement of the base course shall be in close conformity with the lines and grades, thickness and typical cross-sections as shown on the approved plans.

c. Requirements for pavement when curbing is required: Where curbing is to be installed the base course of pavement may be paved a minimum of one foot (1') narrower on each side to allow for the installation of the curb.

2. FINAL WEARING COURSE

a. **Final Wearing Course materials:** Wearing course material shall conform to the specifications in Section 401 of the N.H.D.O.T. Standard Specifications, 2002 Edition for Type E (1/2-inch aggregate) pavement.

b. **Placement of the final wearing course:** Placement of the wearing course shall be in close conformity with the lines and finish grades as shown on the approved plans. It shall be applied on a previous placed base course. All manhole covers, catch basin grates and curbing shall be in place and set to the proper grade before the wearing course is applied.

3. FULL WIDTH BITUMINOUS PAVEMENT OVERLAY

a. **General Requirements:** It shall be the responsibility of the contractor to provide a full width permanent pavement overlay following extensive trench excavations within a public way. The contractor shall furnish all labor and materials to install the bituminous pavement overlay over the full width of the roadway curb-to-curb or shoulder-to-shoulder throughout the entire project limits at the depth specified by the City Engineer. A leveling or shim course of pavement may be required by the City Engineer, to produce a uniform roadway section.

b. **Pavement overlay materials:** The pavement overlay material shall also conform to the specifications in Section 401 of the N.H.D.O.T. Standard Specifications, 2002 Edition for Type E pavements.

c. **Placement of the pavement overlay:** All existing pavement areas and base course trench patched areas are to be brought to a smooth level grade with a hot bituminous leveling shim course. All manhole covers, catch basin frames, water and utility valve boxes and curbing shall be reset to grade prior to overlay placement. The entire area shall be swept and cleaned of all debris.

4. APPLICATION CONDITIONS

a. **Environmental conditions:** The asphalt binder/base pavement shall be placed only when the underlying crushed gravel surface is dry, frost free and the surface temperature is 40° Fahrenheit and rising. For the placement of the final asphalt wearing course, the surface temperature of the binder material must be 50° Fahrenheit and rising.

b. **Waiver of environmental conditions:** In special instances when the City Engineer determines that it is in the best interest of the City of Concord, the above requirements may be waived for base course pavement only. Any material delivered to the spreader having a temperature lower than 250° Fahrenheit shall not be used.

4. APPLICATION CONDITIONS (continued)

c. Thickness of pavement: Unless otherwise noted, thickness of pavement as shown on the approved plans and/or the Typical Roadway Section (See Details #41 - #43), shall be the compacted thickness after rolling.

d. Removal of existing pavement: At the beginning and end of the project or project section, the existing pavement shall be removed to a sufficient depth to allow for the placing of the new pavement and construction of a transverse joint. The underlying course shall be clean and free of any foreign materials and loose bituminous patches and must present a dry and unyielding surface.

e. Requirements for tack coat: A tack coat of emulsified asphalt shall be applied to all lifts of pavement immediately prior to placement unless waived by the City Engineer. The rate of application shall be between 0.02 and 0.05 gal/SY, as determined by the City Engineer. Prior to the application of the tack coat, the asphalt binder surface shall be cleaned to the satisfaction of the City of Concord's Representative. The use of a street sweeper may be required depending on the cleanliness of the surface.

f. Removal of unsatisfactory material: If any imperfect places are found in any course, the contractor shall remove the unsatisfactory material and replace it after coating the exposed edges with a suitable bituminous emulsion.

g. Requirements for cold planing at bituminous joints: Surfaces that are to be overlaid with new bituminous pavement will require cold planing at the overlay joint. The existing bituminous surface shall be removed by a planing or milling machine capable of removing the bituminous pavement to the depth specified at the limits of the overlay, and to provide a smooth transition between the new and existing pavements (See Detail #38A and #39)

E. CURB

1. VERTICAL CURB

a. Physical properties: Vertical granite curb shall be 5-inches wide and 16 to 18 - inches deep. Granite shall be hard, durable, reasonably uniform in appearance and color and free from weakening seams.

b. Placement: Vertical granite curb is to be placed after the asphalt base course of pavement has been applied. Installation of curbing shall be so that the front arris line conforms to the line and grade required. Joints shall be pointed with Portland Cement mortar and the exposed portions finished with a jointer.

1. VERTICAL CURB (continued)

c. Backfilling: Backfilling shall be done immediately after the curb is set and jointed. Backfill shall be crushed gravel placed and thoroughly compacted on both sides of the curbing. Compaction shall be achieved to a minimum of 95% with the use of a vibratory plate compactor or a "Jumping" jack compactor. **The use of hand compaction (i.e., tamping) is not permitted.** Compaction testing shall be required to verify the density.

d. Damaged or unsuitable curbing: Any curbing that is damaged or found unsuitable prior to finish pavement being applied shall be replaced with new curbing.

e. Vertical granite curbing: Vertical granite curbing shall be set with a 7-inch reveal above finish pavement. Tip downs at driveway locations shall be at least 6 feet in length. Refer to Detail #56.

f. Radial cut curbing: Radial curbing shall be used at all curbed roundings when the radius of the rounding is 25-feet or less.

2. SLOPE GRANITE CURB

Slope granite curb shall be 6 to 8-inches wide and 9-inches deep, and shall meet the above requirements for material and installation. The setting reveal (the vertical height of the exposed face when set) shall be 4-inches. Refer to Detail #56.

When slope granite curb is called for on the plans, it shall be used except at all roadway intersections, where vertical granite curb shall be set along the radii. A transition piece of granite curb, 6-feet in length, shall be used between the sloped granite curb and the vertical granite curb. Refer to the "Slope to Vertical Granite Curb" Detail #50.

Backfilling shall be done immediately after the curb is set and jointed. Backfill behind the curb shall be crushed gravel or either NHDOT Item 520.421 – Class "F", Excavatable Flowable Fill. If crushed gravel is placed in front and behind the curb, it shall be thoroughly compacted to a minimum density of 95%.

Compaction shall be achieved with the use of a vibratory plate compactor or a "Jumping" jack compactor. **The use of hand compaction (i.e., tamping) is not permitted.**

The City of Concord's Representative reserves the right to request compaction testing from an independent testing company at any time to ensure that the proper density of 95% or greater has been achieved.

F. SIDEWALKS

1. BITUMINOUS CONCRETE

a. General: This work shall consist of constructing sidewalks of bituminous concrete a minimum of 2-inch thick. Sidewalks shall be constructed to conform to the Americans With Disabilities Act Accessibility Guidelines. Refer to the details for further information.

b. Sidewalk: Sidewalks shall be a minimum of 5-feet in width and shall have a transverse slope of 2%, sloping towards the street. All measurements shall be taken from the top of the granite curbing.

c. Preparation of the base: Preparation of the base shall be accomplished by removing material to a depth of 6-inches below finish grade, except at drive locations where it shall be excavated 9-inches below finished grade. Any unsuitable material found will be removed and replaced with crushed gravel as directed.

d. Crushed Gravel: The excavated area shall be filled with 4-inches of crushed gravel except at driveways where 6-inches of crushed gravel shall be used.

e. Compaction: Prior to the placement of asphalt, all crushed gravel areas are to be rolled and thoroughly compacted to a minimum density of 95% or greater.

f. Base course: After the crushed gravel has been fine graded a one inch base course shall be placed, except at driveways where the base course shall be 2 inches.

g. Bituminous mixtures: All bituminous sidewalks will be constructed with State of NH Sidewalk mix – Section 608, Table 1 – Composition of Mixtures.

h. Sidewalks: At intersections and drive entries, sidewalks shall comply in all respects to the most recently adopted State of New Hampshire Architectural Barrier Free Design Code; i.e. 1-inch per foot maximum as the walkway approaches a drive apron.

2. PORTLAND CEMENT CONCRETE

a. General: This work shall consist of constructing reinforced concrete sidewalks a minimum of 4-inch in thickness (6-inch at drives).

b. Sidewalks: Sidewalks shall be minimum 5-feet in width and shall have a transverse slope of 1/5 inch per foot, sloping towards the street.

c. Preparation of the Base: Preparation of the base shall be accomplished by compacting the select material to a uniform density by rolling or tamping. The base shall consist of 6 inches of crushed gravel on acceptable sub-base material.

d. Compaction: Prior to the placement of the concrete, all crushed gravel areas are to be rolled and thoroughly compacted to a minimum density of 95% or greater. Base compaction testing shall be the responsibility of the contractor and may be ordered by City of Concord's Representative.

F. SIDEWALKS (continued)

e. **Concrete Placement:** Concrete shall have a 28-day strength of 3000 psi, with a maximum slump of 3-inches. Maximum aggregate size shall be 1-inch and 4% to 6 % entrained air shall be added. Testing shall be the responsibility of the contractor and may be ordered by the City Engineer. Before placing the concrete, all foreign materials shall be removed from the base. All forms shall be thoroughly cleaned, secured in position and coated with a form-release agent. Concrete shall be placed, struck off, consolidated, and finished to plan grade with a mechanical machine, vibrating screed or by hand finishing methods when approved.

f. **Finishing:** After concrete has been struck off and consolidated, a bull-float may be used to remove any high or low spots. The final finish shall be made with a clean fine bristled broom, lightly applied in an alternating grid pattern.

g. **Curing:** During curing, concrete shall be protected from loss of moisture, rapid temperature change and mechanical injury for a minimum of three days following the placement. Following the curing period, an approved concrete sealer shall be applied at the rate recommended by the manufacturer.

h. **Joints:** Joint pattern shall be detailed on the construction plans and shall not be altered without prior approval of the City Engineer. Control or contraction joints shall be formed by sawing or by use of a pre-molded filler and shall be a minimum depth of one-fourth the slab thickness. Sawing shall begin when the concrete has hardened sufficiently to permit sawing without excessive raveling. Joints shall be continuous across the slab, be 5/16 inch to 1/4 inch in width and be completed before uncontrolled shrinkage cracks have occurred.

G. DRIVE ENTRY

1. LOCATION AND CONSTRUCTION

a. **Drive entries:** All drive entries shall be located as shown on the approved plans or as directed by the City Engineer.

b. **Locating driveways not shown on the approved plans:** In those areas where the driveways are not located on the approved plans or the proposed driveway location is in question, the developer/owner/contractor shall contact their design engineer and a written letter verifying the sight distance and a plan sheet showing the proposed location of the driveway shall be submitted to the City Engineer for review. **No Driveway Permits will be authorized when the driveway is not shown or is in question. The City of Concord is not responsible for the layout of any commercial or residential driveway.**

c. **Physical dimensions:** Drives shall be located at a minimum of 5-feet from property lines, placement of the drive is dependent upon the location (Urban or Rural) within the City of Concord. Refer to the Driveway Details and Appendices B and C.

d. **Drive aprons:** In subdivisions where sidewalks are required the drive aprons shall be paved to the back of sidewalk. In those areas where there is no sidewalk, the drive aprons shall be paved for a minimum of 10-feet from the gutter.

G. DRIVE ENTRY (continued)

e. Drive openings: Drive openings on residential streets shall be a minimum of 22-feet and a maximum of 28-feet wide at the curb line. Should the driveway lie within a vertical curbed section, the curbs on each side of the drive opening shall be tipped down with stones at least 6-feet long.

f. Construction requirements: Construction requirements for driveways shall be as follows:

6-inches crushed gravel
3-inches hot bituminous pavement (2-inches of base course and1-inch wearing course)

g. Minimum slope: A minimum positive slope of ½-inch per foot shall be required from the edge of ditch line to the right-of-way line. Maximum slope shall not exceed 1-inch per foot.

H. LOAM, SEED, & SLOPE STABLIZATION

l. MATERIALS

a. Requirements: Loam and grass seed shall meet the requirements of Sections 64l and 644 of the NH DOT Standard Specifications.

b. Seed: Generally, park seed Type 15 shall be used on loam areas and slope seed type 44 shall be used for all slope work.

c. Slope Stabilization Products: Maximum slopes for intended for vegetation shall be 3:1. The use of slope stabilization products for slopes equal to or greater than 3:1 such as Geotextile fabrics or other approved alternatives are strongly encouraged in lieu of stone rip-rap where conditions permit.

Shall the contractor request the use of stabilization products in lieu of stone rip-rap as shown on the approved design plans, the contractor shall contact the design engineer for the project and a written letter describing the proposed geotextiles and the stability of the slope using the proposed product, shall be submitted to the City Engineer for review and approval.

2. APPLICATIONS

a. Seeding and initial fertilizing: Seeding and initial fertilizing shall be done between April l and June l, or between August 15 and October 15.

b. Windy weather or frozen ground requirements: Seeding shall not be done during windy weather or when the ground is frozen, excessively wet or otherwise untillable.

c. Preparation for seeding: All areas to be seeded shall be prepared to provide a reasonable firm but friable seed bed. All areas shall meet the specified grades and shall be free from weed growth and debris.

H. LOAM & SEED (Continued)

d. Loam: Loam shall be a minimum of 4" deep and free of debris, roots, stones, or other objectionable materials.

e. Protection and care: The contractor shall be responsible for protecting and caring for the seeded area until final acceptance of the work.

f. Watering: The seeded areas shall be carefully and suitable watered as necessary to produce a satisfactory growth.

g. Re-seeding requirements: Any part of the seeded areas that fail to show a uniform stand shall be re-seeded until all areas are covered with grass.

I. GUARD RAIL

1. Where guardrail and terminal end units are required or shown on the approved plans, the items shall conform to Section 606 of the NHDOT Standard Specifications for Steel Beam Guard Rail and Terminal Units. If the owner/developer/contractor wishes to deviate from the requirement, then a written request shall be sent to the City Engineer for review and approval/disapproval.

Certificates of Compliance shall be submitted by the Contractor for each material to the City of Concord's Representative for review and approval.

Posts with hollow knots, plugged holes, or season checks exceeding ¼ inch in width will be rejected.

Wood posts shall be set plumb.
All wood posts shall be retreated after drilling or sawing.
The wood blockouts shall be "toe nailed" to the rectangular wood posts.

J. RETAINING WALLS

1. **Any** proposed retaining wall proposed on any site (private or public) having a minimum height 4-feet or greater, must be approved by the Engineering Services Division. Detailed shop drawings, stamped and signed by a licensed structural engineer registered in the State of New Hampshire, shall be submitted to Engineering Services at least **3 weeks** prior to the construction of the proposed wall. Shop drawings submittals not bearing the stamp and signature of the structural design engineer shall be rejected.

Retaining walls constructed without an approved set of plans by a registered structural engineer and the City Engineer are subjected to removal and the wall will be reconstructed.

The Engineering Services Division has the right to refuse to sign-off on a Certificate of Occupancy Permit if a retaining wall located on any site has not been approved by a registered structural engineer and the City Engineer, and the workmanship is in question.

K. STREET LIGHTS, TRAFFIC SIGNALS, AND STREET SIGNS

1. STREET LIGHTS

a. Requirements for street light locations: Street lights may be required at intersections, turnarounds and cul-de-sacs. Street light locations shall be as shown on the approved plans and as agreed upon in the field by the City Engineer and the power company representative.

b. Light poles: Light poles shall be treated timber poles or tapered steel or aluminum. All poles shall demonstrate similar appearance and durability. All light poles, lights and their installation shall meet the requirements of **Unitil Energy Systems** located at #1 McGuire Street, Concord, NH.

c. Traffic Signals: Traffic Signal installations shall meet all State and City inspection requirements. All traffic signal installations require fire preemption activated by Opticom Equipment.

All traffic signal apparatus (mast, mast arms, signal heads, & cabinets) shall be painted a black satin or semi-gloss finish (Federal Standard 595B Color #27038).

d. Final acceptance: All street lighting and traffic signal installations shall be in place and operational before final acceptance and reduction of financial guarantees.

2. STREET SIGNS

For new streets the owner or contractor shall be required to provide city street name and traffic control signs. All street, warning, regulatory, etc. signs shall be in accordance with the 2003 Edition of the Manual on Uniform Traffic Control Devices (MUTCD).

Street signs shall be fabricated with diamond grade retro reflective sheeting. Street sign letters will be 6-inches tall on a 9-inch aluminum backing, installed on a “U” shaped steel channel.

L. STREET TREES

Trees benefit the City as a whole both functionally and aesthetically and shall be preserved in the development of building sites.

- No trees are to be planted within 30-feet of an intersection.
- Plantings shall not be placed in locations that inhibit sight distance per AASHTO Policy, Geometric Design of Highways and Streets, 2004 Edition.
- Only City approved trees will be planted under aerial utilities.
- Trees planted with City funds must be planted within 10-feet of the right-of-way so as to benefit the public.
- Trees to be located to avoid conflicts with underground utility services.

M. DUMPSTER PADS

1. Refuse Bins shall be located a minimum of 25-feet from any drainage structure or inlet.

IX. UTILITIES

All underground utilities are to be placed immediately after preparation of the roadway to subgrade, yet prior to placement of select roadway materials in streets under construction. **ALL** underground utilities shall have detectable tape placed 12-inches over the crown of the utility.

When underground utilities are encountered, the contractor shall notify the appropriate agency to assure proper construction procedure in that area. Any damage to a utility is to be reported to and repaired by that utility prior to backfilling.

Any poles, structures, conduits, cables or wires, the location of which **have already been approved** by the local land use board as part of a subdivision, site plan, or other development approval, shall, if such location becomes a public highway, be deemed legally permitted or licensed without further proceedings under RSA 231:61-a; provided, that copies of the appropriate utilities' easements, work plans, or other data showing locations of such structures, are submitted to the municipality for recording purposes.

Any poles, structures, conduits, cables or wires, the location of which **have not been approved** shall be subjected to the approval of the Poles and Wires Board through the Engineering Services Division.

A. WATER /SEWER

The Community Development Department in conjunction with the General Services Department will oversee all work related to those utilities. Unauthorized use of hydrants is strictly prohibited. Should a contractor desire to use City water for dust control, sewer testing and flushing operations, etc. the City will furnish a temporary meter. A deposit is required and the contractor will be charged for the water used.

Only qualified City of Concord personnel are authorized to manipulate hydrants. Unauthorized usage of City water is subject to a minimum $1,000.00 fine.

B. POWER

The Engineering Division requires all underground electric conductors to be contained within rigid conduits at all road crossings. Crossings shall be perpendicular to the roadway whenever possible.

1. Conduit Required

a. 4-inch (min) diameter Schedule 80 PVC or 4-inch (min) diameter rigid steel conduit (installers option).

b. Encasement with low strength concrete (Flowable Fill, NHDOT Type F, Item 520.421) may be allowed for thin walled communication conduit installations.

This requirement applies to all primary and secondary electric service installations within the paved area of the street and extending to a point at least 3-feet, measured perpendicular to the traveled way, beyond the edge of pavement.
For typical roadway installations refer to the appended electrical conduit (See Detail #55).

2. Site Work

Electrical Site Work must be performed by Licensed Electrical Contractors only - ***not General Contractors.***

C. MUNICIPAL CABLES

Municipal fire alarm cable and traffic signal installations are under the jurisdiction of the Fire Departments - Alarm / Traffic Division – (225-8667). This division is to be notified prior to any street alterations especially at signal controlled intersections.

D. GAS, TELEPHONE AND CABLE TV

These underground utility service installations shall cross streets perpendicular to the traveled way in a straight trench, and at a uniform depth at least 12 inches below subgrade. These utilities will be protected under paved areas in conduit and in the manner prescribed by that utility.

E. UTILITY CONFLICTS

1. CROSSINGS

Utility service lines (municipal and private) are to be laid out and installed to avoid crossings whenever possible. Overhead utilities and landscaping should be considered obstructions when proposing a new service location.

2. WATER / SEWER

Should construction operations reveal or expose a water main running approximately parallel to and less than 10-feet from a proposed sewer installation and where it is not practical to relocate the sewer, the sewer shall be reconstructed of ductile iron pressure class pipe until the minimum 10-foot separation can be achieved.

a. Whenever sewers must cross water mains, the sewer shall be constructed of ductile iron pressure class pipe for a minimum distance of 9 feet each side of the crossing. Joints shall be water pressure rated with zero leakage when tested at 25 pounds per square inch for gravity sewers and 1-1/2 times working pressure for force mains, and joints shall not be located within 9 feet of the crossing point.

b. Should the vertical separation of the sewer and water main be less than 18", the water main or the sewer main must be relocated to achieve the required separation.

c. When utilities cross under a **cast iron** water main and the vertical distance between the bottom of water main and the top of the other utility is four feet or greater; the water main shall be cut out and replaced with ductile iron pipe. The new ductile iron pipe section shall span the excavation back into original ground. This procedure will require approval and inspection by the City of Concord's Representative.

5. WATER / STORM DRAIN

Should storm drain pipelines or structures approach water lines or appurtenances with less than 36-inches of separation, then frost protection will be required as directed by the City of Concord Representative.

4. RELOCATION CONFLICTS

In conflicts requiring the relocation of utilities, preference shall be given:

a. To utilities with grade restrictions.
b. To existing utilities already in service.

F. UNUSED/ABANDONED UTILITIES:

Abandoned or unused utilities that are required to be discontinued, sealed, or removed within the scope of a project shall be taken care of prior to placement of select or finished materials such as gravel, pavement, and landscaping. THE CONTRACTOR **SHALL NOT** DISCONNECT ANY SERVICE CONNECTIONS WITHOUT THE PROPER AUTHORIZATION FROM ENGINEERING SERVICES DIVISION AND THE GENERAL SERVICES DEPARTMENT.